General Notes.

MINERALOGY.[1]

An Instrument for Preparing Accurately Oriented Sections and Prisms from Crystals.—Mention has been made in these notes of the valuable instruments which Tutton has designed in connection with his recent studies in the field of chemical crystallography. One of them[2] is an instrument of precision for preparing prisms or sections of the delicate crystals of artificially prepared compounds. The methods now in use for making these preparations require a prodigious amount of labor while securing only a rough approximation to the desired orientation. Of his new instrument Tutton says:

"It is possible by the use of the instrument to grind and polish a truly plane surface in any direction in a crystal so as to be true to that direction to within ten minutes of arc, an amount of possible error which would exercise no measurable influence upon the values of the optical constants. Moreover, this result may be achieved in a small fraction of the time hitherto required, and with only the very slightest risk of fracturing the crystal. An arrangement is also provided by which a second surface may be ground parallel with a like degree of accuracy to the first."

This somewhat elaborate piece of apparatus is constructed like an inverted goniometer with horizontal circle, being provided with graduated disc, the usual centering and adjusting device, telescope, collimator and lamp. A revolving table mounted in an excentric position under the crystal and driven by a turning table, carries a ground glass plate for grinding and a finer one for polishing. The pressure of the crystal on the glass is delicately regulated by means of counterpoised levers which support any desired portion of the weight of the instrument's axis, the remaining portion bearing directly on the crystal.

A larger, stronger, and somewhat modified form of this apparatus[3] has been designed for carrying out the same operations on the hard natural crystals. This form is provided with a cutting apparatus, which, when not in use, is rotated out of the way so as not to interfere

[1] Edited by Dr. Wm. H. Hobbs, University of Wisconsin, Madison, Wis.

[2] Philosophical Transactions, Vol. 185, (1894), A, pp. 887–912.

[3] Tutton, Proc. Roy. Soc., Vol. 57, pp. 324–330.

with adjusting the crystal or grinding. The grinding table is supplied with nine different laps suited to minerals of different degrees of hardness and to artificial crystals. The apparatus may be driven by a small motor, the current from three pint bichromate cells being ample. These instruments are constructed by Messrs. Troughton and Simms, the smaller instrument at a cost of £40, and the larger one, which is adapted for use of mineralogists and chemical crystallographers alike, at a cost of £60.

An Instrument for Producing Monochromatic Light of any Wave Length.—The same author has constructed an instrument to furnish strong light of any desired wave length, which wave length may be changed at will.[4] The source of light is an oxy-coal gas lime lantern and the dispersive apparatus a specially constructed spectroscope in which the telescope is replaced by a collimator tube and slit exactly like the one on the side of the instrument toward the source of light. The prism has a refracting angle of 60°, is prepared from heavy flint glass, and is rotated on a graduated circle so as to allow any desired wave length of the spectrum to pass through the exit slit. This is diffused by a plate of ground glass before it enters the goniometer, total refractometer, or axial angle apparatus, in which it is utilized in determining the index of refraction or the size of the optical angle. It is thus possible to extend indefinitely the measurements to show the amount and character of the dispersion of crystals, while greatly facilitating the measurements themselves. By replacing the exit slit by diaphragms having two or more slits at proper distances apart, composite light made up of any desired wave lengths may be employed, which is very useful in studying crystals with crossed axial planes like brookite.

Other Mineralogical Apparatus.—Wolff[5] gives detailed instructions for making diamond saws suitable for section cutting, also directions for sawing sections so thin that only a small amount of subsequent grinding is necessary.—Federow[6] describes the simplest form of his universal microscope stage, which is specially adapted for rapid petrographical determinations. At the same time he advocates lengthening the heretofore circular opening in his ebonite section holder.

[4] Philosophical Transactions, Vol. 185, (1894), A, pp. 913–941.

[5] Am. Journ. Sci., XLVII, pp. 355–358, (1894).

[6] Zeitsch. f. Kryst., XXIV, p. 602.

Determination of Optical Sign in Random Mineral Sections.—Using the universal microscope stage Federow[7] shows that it is possible and usually quite easy to determine the optical character of a mineral from random sections. In the case of uniaxial minerals the section is revolved between crossed nicols to extinction. It is then tilted first about one and then about the other axis of its ellipse of elasticity. The one of these corresponding to the ordinary ray is distinguished by the resulting *slight* change in double refraction (due entirely to increase of thickness of the slide). Having determined this direction (n_0) it is only necessary to determine by use of the quartz wedge or mica plate whether this direction corresponds to the greater (positive) or less (negative) elasticity. In the case of biaxial minerals a section is sought having the highest double refraction (nearest plane of optic axes). This is now tilted until it gives the lowest possible double refraction, when the light comes through it most nearly along an optic axis. If the angle which this direction makes with the axis of least elasticity (nearly in the plane of the section) is less than 45° (half the optical angle) the mineral is positive, otherwise negative. This latter method is only approximate, but is accurate enough for minerals having an acute optical angle of 75° or less, and these are the only ones in which determination of the optical sign is of much value for purposes of identification.

Pseudochroism and Pseudodichroism.—The same author[8] furnishes an explanation of certain variations in color which are often observed in minerals having a lamellar structure when observed under the microscope. A bundle of white rays incident on any inclined plane separating two lamellæ is in part totally reflected, the reflected portion being obviously made up of more rays from the violet than from the red end of the spectrum. Of the light which is transmitted the red rays are the less refracted, and hence take their direction nearer the axis of the microscope. As a consequence the color observed near the centre of the field is due to the mixing of the red rays with the darkness due to partial total reflection, and it is, therefore, brown. Nearer the margin of the field the more refrangible rays produce green. This effect is observed in ordinary (non polarized) light, and v. Federow proposes to call it *pseudochroism.* If the polarizer is used the amount of total reflection will evidently be greatest when the direction of vibration of the incident light is parallel to the surface of incidence,

[7] Ibidem, pp. 603-605.

[8] Tscherm. min. u. petrog. Mitth., XIV, heft 6.

hence a variation in the depth of the color, called by v. Federow *pseudodichroism*, is observed when the stage is revolved. Of use in distinguishing pseudodichroic substances from truly dichroic substances is the fact that the former always show brown shades in the centre of the field.

Meteorites in Field Columbian Museum.—Farrington has prepared a "Handbook and Catalogue of the Meteorite Collection" of the Field Columbian Museum[9] modeled somewhat after Fletcher's admirable handbook describing the meteorites in the British Museum collection. The popular introduction is well written, with reference for the purpose of illustration to catalogue numbers of typical specimens in the collection. This important collection includes 180 falls or finds and the aggregate weight of the specimens is over 4700 lbs. With the exception of the Canon Diablo specimens, the largest specimens of the collection, are those from Kiowa Co., (Kan.), (466 and 345 lbs.) and the Phillips Co., (Kan.), meteorite (1184½ lbs.). The list includes 355 numbers which are described with considerable detail. Six excellent plates illustrate typical structures.

Crystallography of Wisconsin Minerals.—In a Bulletin of the University of Wisconsin, Hobbs[10] has studied the Wisconsin minerals crystallographically. The specimens are chiefly from the zinc and lead region of the southern part of the State, where they occur in the cavities of limestone, the principal species being calcite, smithsonite, cerussite, galena, sphalerite, azurite, malachite, barite, gypsum, chalcopyrite, marcasite and pyrite. Four generations of calcite are distinguished by different habits as well as by slightly different colors and degrees of translucency. These four types appear in scepter-like parallel growths. The new form 24R $(24.0.\overline{24}.1)$ has a large development on two of the types. At Mineral Point and Highland galena appears in hopper-shaped octahedral as well as arborescent aggregates, and individual crystals show polysynthetic twin lamellæ according to the laws, (*a*) twinning plane a face of the octahedron and (*b*) composition plane a face of the dodecahedron. On sphalerite from Galena, (Illinois), the new form (775) was observed. The azurite of Mineral Point exhibits the new forms (307), $(\bar{2}03)$, $(\bar{2}05)$ and (9.12.8). The "anglesite" from Mineral Point is found to be selenite. Some new crystal habits are observed on marcasite and on cerussite.

[9] Field Columbian Museum. Publication 3, Geol. Ser., Vol. 1, No. 1, pp. 64, pls. 6, (1895).

[10] Bull. Univ. Wis., Sci. Ser., Vol. 1, No. 4, pp. 109–156, pls. 4–8, (1895).

Miscellaneous.—Hillebrand[11] has made an analysis of a tellurium ore which occurs sparingly in the Cripple Creek district of Colorado, and determined it as calaverite. The corrected analysis (disregarding traces of elements) from the Raven Mine is Fe 57.40, Au 40.83, Ag 1.77, total 100.00. The mineral is very imperfectly crystallized, but as a result of a crystallographical examination Penfield thinks it is probably triclinic but near sylvanite in angles and axial ratio. It is interesting by reason of the unusually low percentage of silver, which in the three specimens analyzed ranged from 0.90 to 3.23 per cent.—Emerson[12] notes several peculiar mineral transformations from Massachusetts. The so-called "quartz pseudomorphs" from Middlefield he finds to be serpentine pseudomorphs after olivine resembling the Snarum forms. In a boulder at Holyoke was found calcite probably pseudomorphous after common salt. A large sapphire corundum crystal from Pelham encloses a crystal of allanite which is much puckered for a distance of an inch from the allanite, but elsewhere possesses its usual parting.—v. Federow[13] finds that in the rocks of the shores of the White Sea (granites and gneisses) a vicareous relation seems to exist between plagioclase and garnet, the former being developed in large quantity only when the latter is present in small quantity and vice versa. Hobbs[14] describes cerussite from Missoula, Mont., showing the forms (110), (100), (130), (010), (001), (332), (111) and (380). The crystals are covered by a paper-thin film of galena, doubtless due to alteration through the action of sulphuretted hydrogen. Crystallized barite from Negaunee and chloritoid from Michigamme are also described.

[11] Am. Jour. Sci., Vol. L, pp. 128–131, (1895),
[12] Bull. Geol Soc. Am., Vol. 6, pp. 473, 474, (1894).
[13] Tscher. min. u petrog. Mitth., XIV. pp. 550–553, (1894).
[14] Am. Jour. Sci., L, pp. 121-128, (1895).

PETROGRAPHY.[1]

The Rocks of Gouverneur, N. Y.—An interesting feature of the biotite-hornblende gneisses[2] of the vicinity of Gouverneur, N. Y., is

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.
[2] C. H. Smyth, Jr., Trans. N. Y. Acad. Sciences, xii, p. 203.